

REMARKS

The Applicants are filing this Amendment and Response in response to a Decision of the Board of Patent Appeals and Interferences dated July 13, 2011. At the time of the Decision, claims 1-32 were pending. In response to the Decision, the Applicants have amended claims 1, 13, 28, and 29, and canceled claims 3 and 30-32. No new matter has been added by way of these amendments. Upon entry of the amendments, claims 1, 2, and 4-29 remain pending. Based on the foregoing amendments and the following remarks, the Applicants respectfully assert that all pending claims are in condition for allowance.

In the Final Office Action before Appeal, dated January 11, 2008, the Examiner rejected claims 1-4, 6, 13-17, 19, and 26-32 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent Application Publication No. 2005/0038968 by Iwamura, et al. (hereinafter "Iwamura") and in view of U.S. Patent Application Publication No. 2002/0083281 by Carteau (hereinafter "Carteau"). The Examiner also rejected claims 5 and 18 under 35 U.S.C. § 103(a) as being unpatentable over Iwamura and in view of Carteau as applied to claims 1-4, 6, 13-17, 19, and 26-32, and further in view of U.S. Patent No. 6,912,483 to Frederick (hereinafter "Frederick"). Further, the Examiner rejected claims 7-9 and 20-22 under 35 U.S.C. § 103(a) as being unpatentable over Iwamura and Carteau as applied to claims 1-4, 6, 13-17, 19, and 26-32, and further in view of U.S. Patent No. 6,260,125 to McDowell (hereinafter "McDowell"). Lastly, the Examiner rejected claims 10-12 and 23-25 under 35 U.S.C. § 103(a) as being unpatentable over Iwamura and Carteau as applied to claims 1-4, 6, 13-17, 19, and 26-32, and further in view of U.S. Patent No. 6,098,179 to Harter, Jr. (hereinafter "Harter"). These rejections are discussed in detail below. The Examiner's rejections were affirmed by the Board of Patent Appeals and Interferences in a Decision dated July 13, 2011.

Claim Rejections under 35 U.S.C. § 103(a)

With regard to the rejection of claims 1-4, 6, 13-17, 19, and 26-32 under 35 U.S.C. § 103(a), the Examiner specifically stated that:

With respect to claim 1, Iwamura et al. disclose a data synchronization method for a redundant data storage arrangement

Iwamura et al does not explicitly teach receiving acknowledgements from the second remote storage entity at both the primary storage entity and the first remote storage entity.

Carteau teach,

- receiving acknowledgements from the second remote storage entity at both the primary storage entity and the first remote storage entity (Paragraph 0027 of Carteau);

The combination of Iwamura et al and Carteau teach,

- comparing acknowledgements and sequence numbers in the first sidefile with acknowledgements and sequence numbers in the second sidefile (paragraph 0236; paragraph 0261, lines 3-7 of Iwamura et al and Paragraph 0027 of Carteau); and
- updating writes stored at the second remote storage entity based upon the comparison of the first and second sidefiles (paragraph 0261, lines 3-7 of Iwamura et al).

Final Office Action, p 2-4. The Examiner made similar assertions with regard to the rejection of independent claims 13, and 28-32. Although the Applicants do not concede the correctness of the Examiner's position, independent claims 1, 13, 28, and 29 have been amended as set forth above to recite subject matter that was not considered by the Board.

The burden of establishing a *prima facie* case of obviousness falls on the Examiner. *Ex parte Wolters and Kuypers*, 214 U.S.P.Q. 735 (B.P.A.I. 1979). To establish *prima facie* obviousness of a claimed invention, all the claim limitations must

be taught or suggested by the prior art. *In re Royka*, 180 U.S.P.Q. 580 (C.C.P.A. 1974). Although a showing of obviousness under 35 U.S.C. § 103 does not require an express teaching, suggestion or motivation to combine prior art references, such a showing has been described by the Supreme Court as providing a “helpful insight” into the obviousness inquiry. *KSR Int’l. Co. v. Teleflex, Inc.*, No. 04-1350, 550 U.S. 398, 401, 82 U.S.P.Q.2d 1385, 1389 (2007). Moreover, obviousness cannot be established by a mere showing that each claimed element is present in the prior art. *Id.* The Examiner must cite a compelling reason why a person having ordinary skill in the art would combine known elements in order to support a proper rejection under 35 U.S.C. § 103. *Id.*

The References Cited, alone or in any sort of hypothetical combination, do not disclose all of the elements of independent claims 1, 13, 28, and 29.

Embodiments of the present invention are directed to data synchronization in a redundant data storage system. Specification, para. [0016]; Fig. 1. The data storage system includes primary storage, a first remote storage, and a second remote storage. *Id.*, para. [0018]; Fig. 1. Writes to the first and second remote storage entities may be tracked through sidefiles maintained by the first and second remote storage. *Id.*, paras. [0022] and [0023]; Fig. 1. The primary storage assigns sequence numbers to writes to, among other things, facilitate identification of writes that may be missing at the second remote storage. *Id.*, paras. [0028] and [0029]; Figs. 2A-C. The updating of the second storage may be based on the comparison of the sequence numbers in the sidefiles maintained by the first and second remote storage entities. *Id.*, paras. [0031] and [0039].

Furthermore, embodiments of the present invention are also directed to techniques for adaptively adjusting the number of writes stored to the sidefiles. *Id.*, para. [0050]. To adaptively adjust the number of writes stored to the sidefile of the first remote storage, “primary storage 10 polls second remote storage 30 to determine the maximum contiguous sequence number in sidefile 32.” *Id.*, para. [0052]; Figs. 1 and 5. The primary storage then forwards an indication of the acknowledgements corresponding to

maximum (*i.e.*, newest) contiguous sequence number to first remote storage. *Id.*, paras. [0041], [0054]. The first remote storage may then discard those sequence numbers from its own sidefile that are equal to or older than the maximum contiguous sequence number contained in the sidefile of the second remote storage. *Id.* In this way, the portion of the respective memory consumed by maintaining sidefiles can be minimized while still accommodating “unusual circumstances in which second remote storage 30 lags (in terms of writes) first remote storage 20 by a much greater extent than would have been anticipated by the embodiment which stores a fixed number of writes in each of sidefiles 12 and 22.” *Id.*, para. [0050]; Fig. 1.

Accordingly, independent claim 1 recites, *inter alia*, “generating acknowledgment information based on the newest contiguous sequence number of the second sidefile; sending the acknowledgment information from the primary storage entity to the first remote storage entity; [and] discarding at least some of the sequence numbers from the first sidefile that are equal to or older than the newest contiguous sequence number, based on the acknowledgment information.” Independent claims 13, 28, and 29 contain similar recitations.

In contrast, none of the references cited by the Examiner disclose such a technique for maintaining sidefiles, either alone or in any hypothetical combination. Iwamura discloses an information system that includes a primary site 100, a sync site 170 and an async site 180 connected through a communication line. Iwamura, para. [0040]; Fig. 1. The system disclosed in Iwamura uses time-based logs stored in a log storage area to perform a rollback for database recovery. *Id.* paras. [0245]-[0257]. However, Iwamura does not teach receiving acknowledgements from a second remote storage entity at both a primary storage entity and a first remote storage entity, which the Examiner has conceded. Final Office Action, p. 3. Thus, Iwamura also fails to disclose “generating acknowledgment information based on the newest contiguous sequence number of the second sidefile; sending the acknowledgment information from the primary storage entity

to the first remote storage entity; [and] discarding at least some of the sequence numbers from the first sidefile that are equal to or older than the newest contiguous sequence number, based on the acknowledgment information,” as generally recited in independent claims 1, 13, 28, and 29.

Carteau does not remedy the deficiencies of Iwamura. Carteau merely teaches a computer coupled to two disk subsystems mirrored through duplication controlled by the disk controllers. Carteau, para. [0027]. After a controller receives a write request from a host, the controller writes the request to a disk and transmits the request to the second controller. *Id.* The second controller sends an acknowledgement to the first controller, which then acknowledges the write to the host. *Id.* A corresponding entry in a log file of the first controller is then deleted based on the acknowledgment received from the second controller. *Id.*, para. [0036]. In other words, Carteau describes a system comprising two storage entities wherein communication of acknowledgements is between the first storage controller and the second storage controller. This stands in contrast with the recitation of claims 1, 13, 28, and 29 wherein acknowledgments related to the second remote storage are received at the first remote storage from the primary storage. Moreover, nothing in Carteau states that one *or more* log file entries are deleted based on a newest contiguous sequence number of a sidefile maintained by a second remote storage. Rather, in Carteau, log file entries of a first disk subsystem are individually deleted upon receiving a corresponding acknowledgment directly from the second disk subsystem. Thus, Carteau fails to disclose “generating acknowledgment information based on the newest contiguous sequence number of the second sidefile; sending the acknowledgment information from the primary storage entity to the first remote storage entity; [and] discarding at least some of the sequence numbers from the first sidefile that are equal to or older than the newest contiguous sequence number, based on the acknowledgment information,” as generally recited in independent claims 1, 13, 28, and 29.

Furthermore, the Frederick, Harter, and McDowell references do not remedy the deficiencies of Iwamura and Carteau. Frederick is directed to a method of maintaining a historical database of information. Frederick, col. 2, ll. 13-16. However, Frederick does not disclose a redundant data storage arrangement, much less techniques for updating a sidefile used in data synchronization. Indeed, the Examiner merely cited Frederick for its disclosure of overwriting old log entries with new log entries in a circular fashion. Final Office Action, pp. 16 and 17 (citing Frederick, col. 6, ll. 54-55.) Harter is directed to methods of performing error detection in a shared memory network. Harter, col. 3, ll. 53-57. However, Harter does not disclose a redundant data storage arrangement, much less techniques for updating a sidefile used in data synchronization. Indeed, the Examiner merely cited Harter for its disclosure of updating an acknowledgement field. Final Office Action, pp. 22-24 (citing Harter, col. 7, l. 65 – col. 8, l. 4). Accordingly, both Frederick and Harter fail to disclose “generating acknowledgment information based on the newest contiguous sequence number of the second sidefile; sending the acknowledgment information from the primary storage entity to the first remote storage entity; [and] discarding at least some of the sequence numbers from the first sidefile that are equal to or older than the newest contiguous sequence number, based on the acknowledgment information,” as generally recited in independent claims 1, 13, 28, and 29.

McDowell is directed to a disk mirroring system with two storage volumes connected through a network. McDowell, col. 2, ll. 58-65. A transactional manager is used to direct writes to a secondary mirrored volume over the network. *Id.*, col. 4, ll. 65-67. If the network becomes unavailable, queued write transactions can be written to a non-mirrored log file maintained by the transactional manager. *Id.*, col 5, ll. 21-23; Fig. 4. However, McDowell fails to disclose a first sidefile maintained by a first remote storage and a second side file maintained by a second remote storage. Accordingly, McDowell fails to disclose “generating acknowledgment information based on the newest contiguous sequence number of the second sidefile; sending the acknowledgment information from the primary storage entity to the first remote storage entity; [and]

discarding at least some of the sequence numbers from the first sidefile that are equal to or older than the newest contiguous sequence number, based on the acknowledgment information,” as generally recited in independent claims 1, 13, 28, and 29.

In rejecting dependent claims 7-9 and 20-22, the Examiner cited McDowell as disclosing “wherein the adaptive adjustment is based upon the writes that are stored in the second sidefile.” Final Office Action, p. 18 (citing McDowell, col. 8, ll. 3-6). However, the cited portion of McDowell merely states “[t]o keep the log file sizes manageable, the source and target must periodically agree on the last known write and synchronize their log files to that write, deleting what came before.” McDowell, col. 8, ll. 3-6. This disclosure of McDowell is inapposite with regard to the present claims. At least one difference is that the “last known write” of McDowell is not the equivalent of the “newest contiguous sequence number” of the present claims. As shown in the example sidefile of Fig. 2C of the present specification, the last known write stored to the second sidefile has a sequence number of 5, whereas the newest contiguous sequence number in this example is 3. *See* Specification, para. [0041]; Fig. 2C.

For at least the reasons discussed above, the cited references, alone or in any sort of hypothetical combinations, fail to disclose all of the elements of independent claims 1, 13, 28 and 29. Accordingly, independent claim 1, 13, 28, and 29 allowable over these references. Thus, for at least the same reasons as discussed above, claims 2 and 4-27, which depend from claims 1 and 13, respectively, are allowable. Therefore, the Applicants respectfully request that the Examiner withdraw the rejection under 35 U.S.C. § 103(a) and allow the claims to issue.

The Applicants Respectfully Request Withdrawal of the Rejections under 35 U.S.C. 103(a).

The cited references relied upon by the Examiner, either alone or in any sort of hypothetical combination, fail to disclose all of the elements of claims 1, 2, and 4-29. Accordingly, those claims cannot be rendered obvious by the cited references. The Applicants therefore respectfully request withdrawal of the rejections under 35 U.S.C. § 103(a). An indication of the allowability of those claims is earnestly solicited.

Conclusion

The Applicants respectfully assert that all pending claims are in condition for allowance. However, if the Examiner wishes to discuss any issue regarding the present application by way of a telephone conference, the Examiner is kindly invited to contact the undersigned attorney at the telephone number indicated below.

Respectfully submitted,

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